REMARKS

This paper is being provided in response to the Final Office Action mailed April 19, 2005, for the above-referenced application. In this response, Applicants have amended claims 1, 7, 20 and 26 to clarify that which Applicants consider to be the invention. Further, Applicants have amended the Title for purposes of clarification. Applicants respectfully submit that the amendments to the claims are fully supported by the originally-filed specification and that the amendment to the Title does not add new subject matter.

The objection to the Title has been addressed by amendments contained herein. Accordingly, Applicants respectfully request that this objection be reconsidered and withdrawn.

The rejection of claims 1-5 and 20-24 under 35 U.S.C. 102(e) as being anticipated by U.S. Published Patent Application No. 2003/0052414 A1 to Cowens et al. (hereinafter "Cowens") is hereby traversed and reconsideration is respectfully requested in view of the amendments to the claims contained herein.

Independent claim 1, as amended herein, recites a semiconductor device. An interconnect layer is provided on a semiconductor substrate. A protective film is provided on the interconnect layer. An electrode pad is provided on the protective film. An anti-oxidizing layer containing a same element which is the same as an element in the interconnect layer that is chemically bonded or alloyed with a different element which is different from the element contained in the interconnect layer is disposed between the interconnect layer and the protective film. The electrode pad is in electrical contact with the interconnect layer and is disposed on said

protective film in a position to permit contact by a probe. The different element of the anti-oxidizing layer has a lower oxidation-reduction potential than that of the element contained in position that inhibits corrosion of the interconnect layer when an interface between the electrode pad and the interconnect layer is damaged by said probe. Claims 2-7 depend directly or indirectly on independent claim 1.

Independent claim 20, as amended herein, recites a semiconductor device. An interconnect layer is provided on a semiconductor substrate. A protective film is provided on the interconnect layer. An electrode pad is provided on the protective film. An anti-oxidizing layer containing a same element which is the same as an element in the interconnect layer that is chemically bonded or alloyed with a different element which is different from the element contained in the interconnect layer is disposed between the interconnect layer and the protective film. The electrode pad is in electrical contact with the interconnect layer and is disposed on said protective film in a position to permit contact by a probe. The anti-oxidizing layer is disposed on the interconnect layer in a position that inhibits corrosion of the interconnect layer when an interface between the electrode pad and the interconnect layer is damaged by said probe. Claims 21-26 depend directly or indirectly on independent claim 20.

The Cowens reference discloses a plasma condition method for improving adhesion between an integrated circuit chip and an insulating underfill material. The Office Action references Figure 2A in which is shown an interconnection copper layer 201 covered by a protective overcoat 202 (typically silicon nitride) and cited in the Office Action as an anti-

oxidizing layer. The Office Action further cites polymer coat 205 as a protective film and solder bump 207 as an electrode pad. (See paragraph 0044 of Cowens.)

Applicants' independent claims, as amended herein, recite that in a semiconductor device, an electrode pad is in electrical contact with an interconnect layer and is disposed on a protective film in a position to permit contact by a probe, wherein an anti-oxidizing layer, containing a same element as in the interconnect layer and a different element than is in the interconnect layer, is disposed between the interconnect layer and the protective film in a position that inhibits corrosion of the interconnect layer when an interface between the electrode pad and the interconnect layer is damaged by said probe. The oxidation of the interconnect metal is effectively inhibited by the action and configuration of the anti-oxidizing layer, even when a part of the interconnect layer is exposed by the contact of the probe. Since the semiconductor device as presently claimed has the anti-oxidizing layer between the interconnect layer and the protective film, even though the upper layer of the interconnect layer is damaged in the case of being poked with the probe and the surface of the interconnect layer is exposed, the different element in the anti-oxidizing layer, which is different from an element contained in the interconnect layer, is oxidized by containing the atmospheric air. Thus, the chemically stable layer that prevents the corrosion of copper is formed on the surface of the interconnect layer, and thereby inhibiting the deterioration of the semiconductor device.

The present claimed invention prevents the corrosion of the interconnect layer in the case of being poked with the probe, by providing the synergistic effect of the protective film and the anti-oxidizing layer configured as claimed. (See page 6, lines 9 - page 7, line 4 of the present

application.) In particular, the anti-oxidizing layer configured as recited and including a same element as is in the interconnect layer that is chemically bonded or alloyed with a different element from the interconnect layer more surely inhibits the undesired corrosion. (See page 10, lines 4-11 and page 13, lines 10-24 of the present application.)

Applicants respectfully submit that Cowens does not teach or fairly suggest at least the above-noted features as claimed by Applicants. Specifically, as agreed in the Office Action, Cowns does not disclose the anti-oxidation layer wherein the layer comprises a same element as in the interconnection layer and a different element from the interconnect layer that offers as is recited by Applicants and which offers the above-noted advantages. Accordingly, Applicants repsectfully request that this rejection be reconsidered and withdrawn.

The rejection of claims 6 and 25 under 35 U.S.C. 103(a) as being unpatentable over Cowens in view of U.S. Patent Application Publication No. US 2002/0121692 A1 to Lee et al. (hereinafter "Lee") is hereby traversed and reconsideration is respectfully requested.

The features of independent claims 1 and 20 are discussed above with respect to Cowens. Claims 6 and 25 depend therefrom.

The Lee reference discloses a method of creating a fine pitch solder bump. The Office Action cites Lee as disclosing the use of a titanium nitride layer as a protective layer.

Applicants respectfully submit that Lee does not overcome the above-noted deficiencies of the Cowens reference with respect to Applicants' presently claimed invention. Accordingly, Applicants respectfully request that this rejection be reconsidered and withdrawn.

The rejection of claims 7 and 26 under 35 U.S.C. 103(a) as being unpatentable over Cowens in view of U.S. Patent No. 6,617,687 to Akram et al. (hereinafter "Akram") is hereby traversed and reconsideration is respectfully requested.

Certain features of claims 7 and 26 have been incorporated into independent claims 1 and 20. Consequently, Applicants address also address this rejection in view of the amendments made to independent claims 1 and 20.

The Akram reference discloses a method of forming a test insert for interfacing a device containing contact bumps with a test substrate. The Office Action cites Akram as disclosing a group IV element layer of titanium nitride on top of a layer of aluminum. The Office Action then goes on to suggest that it would have been obvious for one of ordinary skill in the art to use this multi-layer disclosed by Akram with an aluminum bottom over the aluminum contact (211) of Cowens for the purpose of preventing unwanted permanent or chemical bonding between surrounding metal layers (See col. 7, lines 43-53).

Applicants point out that the passage of Akram cited in the Office Action with respect to "preventing unwanted permanent or chemical bonding" refers to the top titanium nitride or titanium layer applied over a bottom aluminum layer. Applicants have amended claim 1 and 20

to make it clear that the anti-oxidizing layer as present claimed by Applicants includes a same element as the interconnect layer that is chemically bonded or alloyed with a different element than the interconnect layer. As noted above, this anti-oxidizing layer is configured to inhibit corrosion of the interconnect layer when an interface between said electrode pad and said interconnect layer is damaged by a probe. Application of the above-noted steps described in the Office Action resulting from a combination of Cowens and Akram would result in a titainum-nitride or titanium top layer applied over an aluminum bottom layer. Applicants submit that such a multi-layer does not disclose the anti-oxidizing layer having a same element as an interconnect chemically bonded or alloyed with a different element from the interconnect layer that is utilized to inhibit corrosion of the interconnect layer. Accordingly, Applicants submit that neither Cowens nor Akram, taken alone or in combination, teaches or fairly suggests an anti-oxidizing layer having at least the features as presently claimed by Applicants.

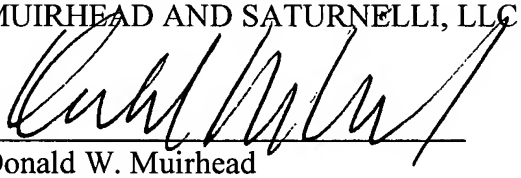
Furthermore, Applicants submit that neither of the devices of Akram and Cowens are directed to inhibiting corrosion of an interconnect layer when an interface between an electrode pad and the interconnect layer is damaged by a probe. Specifically, Cowens is directed to improving adhesion of an IC chip to an underfill layer and the Cowens layer 202 cited in the Office Action as an anti-oxidizing layer is positioned on the peripheral edges of solder bump and not in a path the is likely to contact the interface between an electrode pad and the interconnect layer that is damaged by a probe. Moreover, the element of Akram utilized by the Office Action in combining with Cowens is for the stated purpose of "preventing unwanted permanent or chemical bonding." Consequently, Applicants respectfully submit that, in addition to failing to disclose the features of the presently claimed invention noted above, neither Akram nor Cowens,

taken alone or in combination, teach or fairly suggest that the anti-oxidizing layer is disposed between the interconnect layer and the protective film in a position that inhibits corrosion of the interconnect layer when an interface between the electrode pad and the interconnect layer is damaged by the probe.

Accordingly, in view of the above, Applicants respectfully request that this rejection be reconsidered and withdrawn.

Based on the above, Applicants respectfully request that the Examiner reconsider and withdraw all outstanding rejections and objections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 508-898-8603.

Respectfully submitted,
MUIRHEAD AND SATURNELLI, LLC



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